SVKM's D. J. Sanghvi College of Engineering

Program: B.Tech in Chemical Academic Year: 2022 Duration: 3 hours

Engineering Date: 12.01.2023

Time: 10:30 am to 01:30 pm

Subject: Chemical Process Safety and Utilities (Semester V)

Marks: 75

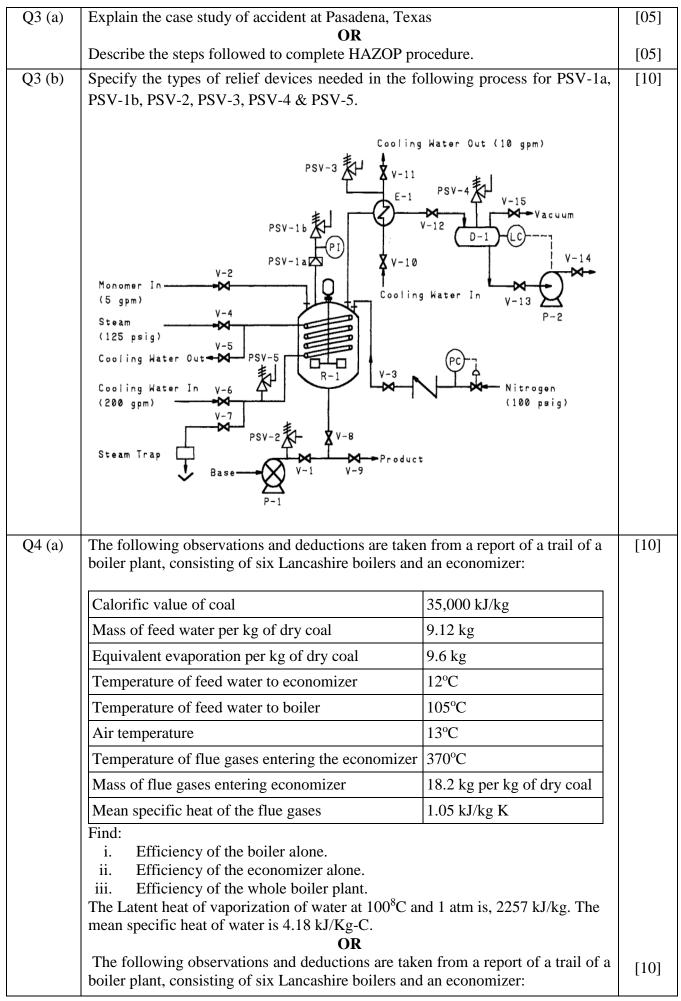
Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

- (1) This question paper contains three pages.
- (2) All questions are compulsory.
- (3) All questions carry equal marks.
- (4) Answer to each new question is to be started on a fresh page.
- (5) Figures in the brackets on the right indicate full marks.
- (6) Assume suitable data wherever required, but justify it.

Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	Estimate the LFL and the UFL for hexane.	[05]
	OR What are the three subcategory types of spring-loaded pressure reliefs?	[05]
Q1 (b)	Failure of a threaded 1%" drain connection on a rich oil line at the base of an absorber tower in a large (1.35 MCFID) gas producing plant allowed the release of rich oil and gas at 850 psi and -40°F. The resulting vapor cloud probably ignited from the ignition system of engine driven recompressors. The 75' high X 10' diameter absorber tower eventually collapsed across the pipe rack and on two exchanger trains. Breaking pipelines added more fuel to the fire. Severe flame impingement on an 11,000-horsepower gas turbine-driven compressor, waste heat recovery and super-heater train resulted in its near total destruction. Identify the initiation, propagation, and termination steps for this accident.	[10]
Q2 (a)	A single-cylinder, single-acting reciprocating air compressor has a cylinder of 24 cm diameter and linear piston speed of 100 m/min. It takes in air at 100 kPa and delivers at 1mPa. Determine the indicated power of the compressor. Assume the law of compression to be $pv^{1.24} = constant$. The temperature of air at inlet is 288 K.	[10]
	A single-cylinder, single-acting reciprocating air compressor has a cylinder of 25 cm diameter and linear piston speed of 100 m/min. It takes in air at 100 kPa and delivers at 1mPa. Determine the indicated power of the compressor. Assume the law of compression to be pv ^{1.24} = constant. The temperature of air at inlet is 288 K.	[10]
Q2 (b)	A process has a reported FAR of 2. If an employee works a standard 8-hr shift 300 days per year, compute the deaths per person per year.	[05]

******* 1 *******



******* 2 *******

	Calorific value of coal	30,000 kJ/kg	
	Mass of feed water per kg of dry coal	9.1 kg	
	Equivalent evaporation per kg of dry coal	9.6 kg	
	Temperature of feed water to economizer	12°C	
	Temperature of feed water to boiler	105°C	
	Air temperature	13°C	
	Temperature of flue gases entering the economizer	370°C	
	Mass of flue gases entering economizer	18.2 kg per kg of dry coal	
	Mean specific heat of the flue gases	1.05 kJ/kg K	
	Find: i. Efficiency of the boiler alone. ii. Efficiency of the economizer alone. iii. Efficiency of the whole boiler plant. The Latent heat of vaporization of water at 100 ⁸ C a mean specific heat of water is 4.18 kJ/Kg-C.	and 1 atm is, 2257 kJ/kg. The	
Q4 (b)	What is Equivalent Evaporation in Boiler?		[05]
Q5 (a)	 Explain any two. i. Flammability Diagram ii. Deflagration iii. Centrifugal Compressor iv. Super heater in boiler 		[05] [05] [05] [05]
Q5 (b)	A diagram of the safety systems in a certain chemical This reactor contains a high-pressure alarm to aler dangerous reactor pressures. It consists of a pressure connected to an alarm light indicator. For addition pressure reactor shutdown system is installed. This system what higher than the alarm system and connected to a solenoid valve in the reactor feed line the flow of reactant in the event of dangerous pressures system.	t the operator in the event of ure switch within the reactor nal safety an automatic high- ystem is activated at a pressure onsists of a pressure switch e. The automatic system stops	[05]

******** 3 *******